

# Morphological description of inflorescences for four species of the genus *Phyllostachys* (Poaceae: Bambusoideae)

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**Abstract:** Based on the reliable flowering specimens collected from some populations of *Phyllostachys* in eastern China, field investigations and anatomical observations, the morphological characteristics of the inflorescence, pseudospikelet and floret of four species within this genus, *Ph. dulcis* McClure, *Ph. longiciliata* G. H. Lai, *Ph. purpureociliata* G. H. Lai and *Ph. yunhoensis* S. Y. Chen et C. Y. Yao, were described and supplemented, and the photos of flowering branchlets and inflorescences showing main characters were provided. All the vouchers were deposited in Herbarium of Guangde Forestry Institute, Anhui Province (GDFI).

**Key words:** Bambusoideae, *Phyllostachys*, floral morphology, *Phyllostachys dulcis*, *Phyllostachys longiciliata*, *Phyllostachys purpureociliata*, *Phyllostachys yunhoensis*

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## 四种刚竹属植物花器官形态描述

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**摘要:** 根据采自华东地区的一些刚竹属植物居群中的可靠花枝标本、现场调查和解剖观察, 描述和增补了白哺鸡竹、瓜水竹、谷雨竹、云和哺鸡竹的花序、假小穗和花部形态特征, 并提供了显示花枝外貌和花器官主要特征的照片。所有的凭证标本均保存于安徽省广德县林业科学研究所竹类标本室。

**关键词:** 竹亚科, 刚竹属, 花部形态, 白哺鸡竹, 瓜水竹, 谷雨竹, 云和哺鸡竹

*Phyllostachys* Sieb. et Zucc., a large, economically important genus of about 60 species in Bambusoideae (Ma et al, 2014), is distributed in eastern Asia to western Himalaya, especially in subtropical China, with a few species in Vietnam, Burma and northern India. In this genus, the floral morphology of 36 species has been described (Lai, 2013; Wang & Stapleton, 2006; Lai, 2001b; Lai, 2001a; Wang et al, 1996), and the floral characters of the rest are still unknown. In the course of investigations on bamboo germplasm resources from eastern China in recent years, the populations of some species within this genus were found in the flowering state, and the specimens of the flowering branchlets were collected as vouchers and were deposited in Herbarium of Guangde Forestry Institute, Anhui Province (GDFI). Based on the specimens, field observations and anatomical records, the floral morphology of four species is described and supplemented for the first time as follows.

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## 1 *Phyllostachys dulcis* McClure, Journ. Wash.

*Phyllostachys dulcis* McClure, Journ. Wash. Acad. Sci. **35** (9): 285, f. 2. 1945.

**Descr. fl. add.:** Inflorescence iterant, flowering branchlets lateral on branch nodes, spicate, base subtended by some bracts that are imbricate and upward gradually enlarged, the superiors spathaceous, the largest 15–17 mm long, initially dark-purple, later withered-yellow, inconspicuously about 15-nerved, apex mucronate or long-acuminate, back glabrous, margins sparsely ciliate; sometimes only inferiorly wrapped by 2 or 3 spathaceous-bracts, bracts 22–25 mm long, initially greenish-purpurate, obviously 17–19-nerved, apex with long-ovate or lanceolate reduced leaf, mouth not auriculate but with several setae on each shoulder. Pseudospikelets (1 or) 2 in each bract, sessile. Glume 1 (–3) (if 2 or 3, the superior more larger than the inferior), 10–15 mm long, back not or faintly 1-porcate and slightly nerved, apex long-acuminate, margins sparsely ciliate or subglabrous. Florets (1 or) 2 in each pseudospikelet, comparely gracile; lemma thinly chartaceous, 13–19 mm long, in the exposed part purple and in the covering part greenish, back with 1 faint ridge and several veins, apex long-acuminate and puberulous; palea submembranous, slightly shorter than or about as long as lemma, back 2-keeled and glabrous, apex bifid; lodicules 3, membranaceous, narrowly lanceolate, whitish; stamens 3; anthers initially yellowish-greenish, later yellowish, 8–12 mm long; filaments separated, white, 25–38 (–49) mm long, glabrous; ovary long-ovate or urceolate, glabrous; style 1, white, 11–18 mm long, glabrous; stigmas 3, white, 3–4 mm long, plumose. Flowering in April and May.

China, Anhui Province, Guangde County, Taozhou Town, Changshanling, *G. H. Lai 14001*.

This species was introduced from a cultivating population in Zhejiang and Anhui border into Guangde National Bamboos Germplasm Bank in November 2011 and cultivated under No. 192. Some of the plants began to flower in the spring of 2014 and continued until May 2017.

## 2 *Phyllostachys longiciliata* G. H. Lai

*Phyllostachys longiciliata* G. H. Lai, Subtrop. Pl. Sci. **42** (1): 53, f. 1. 2013.

**Descr. fl. add.:** Inflorescence iterant, flowering branchlets lateral on branch nodes or terminal on branchlets, densely capitate, composed of 7–11 sessile pseudospikelets gathered into fascicle; terminal inflorescence inferiorly wrapped by 5 or 6 branch-sheaths that are yellowish-green and upward gradually shortened; sheaths pubescent toward the apex of the back and straightly setose on each shoulder of the mouth, the largest 20–32 mm long, apex with 15–45 × 6–12 mm lanceolate or ovate-lanceolate reduced leaf; the smallest covering a side of the inflorescence, 8–15 mm long, apex with 8–12 × 1–3 mm or subulate reduced leaf; lateral inflorescence not vaginated but basally subtended by upward gradually enlarged, imbricate some bracts, the largest 9–11 mm long, back 7–9-nerved, apex caducously mucronate. Pseudospikelet gracile, with 2 florets. Glume 1, glabrous, 8–9 mm long, apex long-acuminate, back 1-porcate and slightly nerved toward the apex. Floret small; lemma narrowly lanceolate, thinly chartaceous, initially yellowish-green, 7–10 mm long, back 1-porcate and about 6-nerved but not tessellated, apex long-acuminate; palea thinly chartaceous, greenish, usually slightly longer than or about as long as lemma, back 2-keeled, margins short-ciliate above the middle part, apex slightly bifid; lodicules 3, membranaceous, nearly band-shaped, 2–2.5 mm long, white, ciliate toward the apex; stamens 3; anthers initially yellowish-green, later yellowish, band-shaped, 5.5–7 mm long; filaments separated, white, 13–15 mm long, glabrous; ovary flask-shaped, 1.5–2 mm long, about 1 mm wide at the base, glabrous; style 1, white, 3–3.5 mm long, glabrous; stigmas 3, white, 2.5–3.5 mm long,

plumose. Flowering in May.

China, Anhui Province, Guangde County, Taozhou Town, Hengshan National Forest Park, Anhui Bamboo Garden, *G. H. Lai 14003*.

This species was introduced from a cultivating population in Bamboo Garden of Zhejiang Academy of Forestry into Anhui Bamboo Garden in September 1999 and cultivated under No. 99-121. In May 2014, a few plants bloomed, but returned to normal vegetative growth in the following year.

### 3 *Phyllostachys purpureociliata* G. H. Lai

***Phyllostachys purpureociliata*** G. H. Lai, *Pl. Divers. Resour.* **35** (2): 138, f. 4. 2013.

**Descr. fl. add.:** Inflorescence iterant, flowering branchlets lateral on branch nodes, spicate, composed of 3–5 sessile pseudospikelets, base subtended by 5 or 6 bracts that are imbricate and upward gradually enlarged, the largest 19.5–23.5 × 6–7 mm, back glabrous, 17–19-nerved, mouth slightly straightly setose on each shoulder, margins sparsely caducously ciliate, apex subulate-mucronate. Pseudospikelet 20–30 mm long, with (1 or) 2 florets, basally 1-spathaceous; spathe initially green or yellow-green, purpurate toward the apex or only at the margins, later withered-yellow, 21–25 mm long, back glabrous, 19–23-nerved but not tessellated, margins densely caducously short-ciliate, mouth setose on each shoulder or almost not, apex with variable (broadly ovate to subulate), purple-green or green reduced leaf. Glumes 2, the first submembranous, 12–15 mm long, back pilose, margins ciliate, apex acute or hebetate; the second similar to lemma, thinly chartaceous, 16–20 mm long, back 1-porcate and glabrous, margins short-ciliate, apex acuminate or long-acuminate. Floret stronger; lemma thinly chartaceous, initially yellowish-green, 21–26 mm long, back puberulous toward the apex, 1-porcate and 13–15-nerved but not tessellated, apex long-acuminate; palea thinly chartaceous to submembranous, yellowish-green or greenish, shorter than lemma, 20–25 mm long, glabrous, back 2-keeled, apex puberulous and obviously bifid; lodicules 3, small, membranaceous, nearly band-shaped, 1.5–2 mm long, white, margin slightly short-ciliate; stamens 3; anthers initially yellowish, dark-yellow when dry, band-shaped, 9–14 mm long, basally hastate; filaments separated, white, 23–35 mm long, glabrous; ovary ovate or subtriangular, 2–4 mm long, about 1–1.5 mm wide at the base, glabrous, stipitate; stipe 1.5–5 mm long; style 1, white, 13–16 mm long, glabrous; stigmas 3, white, 5–8 mm long, plumose. Flowering in April.

China, Zhejiang Province, Suichang County, Miaogao Town, Jinxi Village, *G. H. Lai et al. 15032*.

This species, with mass flowering, grows on the banks of the river in the locality. The bamboo forest is in a state of decline during the investigation, and some of the flowered plants had died.

### 4 *Phyllostachys yunhoensis* S. Y. Chen et C. Y. Yao

***Phyllostachys yunhoensis*** S. Y. Chen et C. Y. Yao, *Act. Phytotax. Sin.* **18** (2): 183, f. 7. 1980.

**Descr. fl. add.:** Inflorescence iterant, flowering branchlets lateral on branch nodes, spicate, composed of 5–7 sessile pseudospikelets, base subtended by 4 or 5 bracts that are imbricate and upward gradually enlarged, the largest 15–19 × 3.5–4.5 mm, back glabrous and about 16-nerved, mouth slightly straightly setose on each shoulder, margins very short ciliate, apex subulate-mucronate. Pseudospikelet 21–23 mm long, with (1 or) 2 (or 3) florets (sometimes the inferior with 1 reduced floret only), base 1-spathaceous; spathe initially yellowish-green and sometimes purpurate toward the apex, later withered-yellow, 18–23 mm long, back pubescent or subglabrous, 13–17-nerved and sometimes tessellated, margins densely caducously short-ciliate, mouth setose on each shoulder or

almost not, apex with ovate-lanceolate to subulate, purple-green reduced leaf. Glume 1, dorsally glabrous, 1-porcate and 9–11-nerved; ones in the inferior pseudospikelets thinly chartaceous, 13–15 mm long, apically acuminate or long-acuminate; ones in the middle and the superior pseudospikelets submembranous, 8–12 mm long, apically hebetate. Floret stronger; lemma chartaceous, initially yellowish-green, sometime purpurate toward the apex, 20–24 mm long, back glabrous or rarely puberulous, 1-porcate and 9–11-nerved but not tessellated, apex long-acuminate; palea thinly chartaceous, yellowish-green or greenish, obviously or slightly shorter than lemma, 19–22 mm long, glabrous, back 2-keeled, apex slightly bifid; lodicules 3, small, membranaceous, subtriangular or subovate, 1–2 mm long, white, faintly nerved at the middle part; stamens 3; anthers initially yellowish, band-shaped, 8–11 mm long, basally hastate; filaments separated, white, 35–56 mm long, glabrous; ovary broadly ovate, 2.5–3 mm long, about 1 mm wide at the base, glabrous, stipitate; style 1, white, 14–20 mm long, glabrous; stigmas 3, white, 6–10 mm long, plumose. Flowering in April.

China, Zhejiang Province, Longquan City, Anren Town, Yanshanling, *G. H. Lai et al. 15050*.

This species, with mass flowering, grows on a mountain slope in the locality. The bamboo forest is in a state of decline during the investigation, and a few flowered plants had died.

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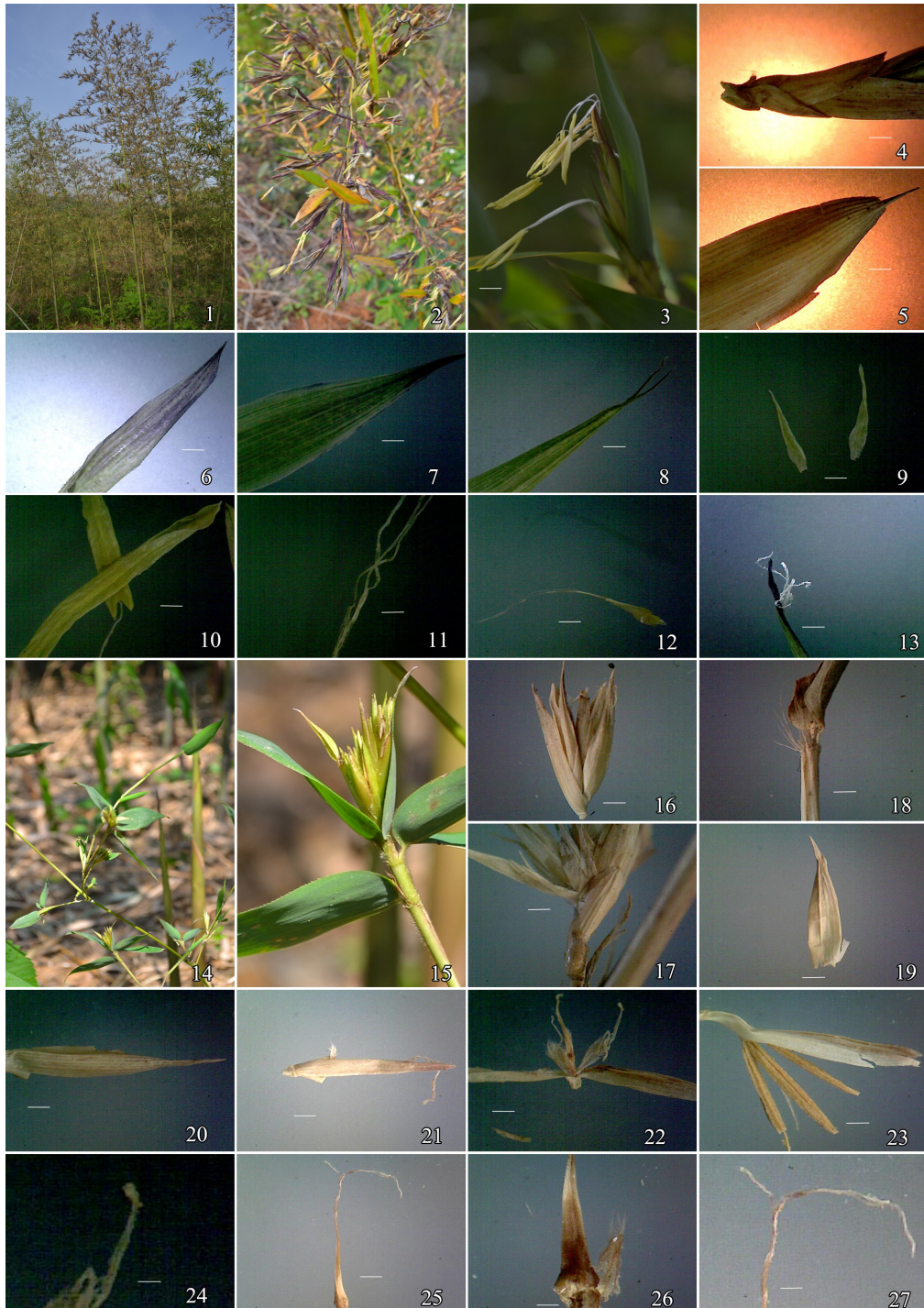


Plate I 1–13 *Phyllostachys dulcis* McClure 1. Flowering plants; 2. Flowering branches, showing spicate iterant inflorescence; 3. Pseudospikelet; 4. Bracts at the base of pseudospikelet; 5. Middle and upper part of bract in dorsal view; 6. Glume in ventral view; 7. Middle and upper part of lemma in ventral view; 8. Upper part of palea in ventral view; 9. Lodicules; 10. Anthers; 11. A part of filament; 12. Ovary and style; 13. Stigmas. 14–27 *Phyllostachys longiciliata* G. H. Lai 14. Flowering plants; 15. Flowering branches, showing capitate iterant inflorescence; 16. A capitate iterant inflorescence; 17. Bracts at the base of iterant inflorescence; 18. Largest branch-sheath at the base of iterant inflorescence; 19. Glume in dorsal view; 20. Lemma in lateral view; 21. Palea in lateral view; 22. Lodicule; 23. Anthers; 24. A part of filament; 25. Ovary and style; 26. Ovary with a lodicules; 27. Stigmas. Scale bars: 3–8, 18=5 mm; 9–13, 20,



23, 24, 26=1 mm; 16, 17, 19, 22=2 mm; 21, 25=0.8 mm; 27=0.5 mm.

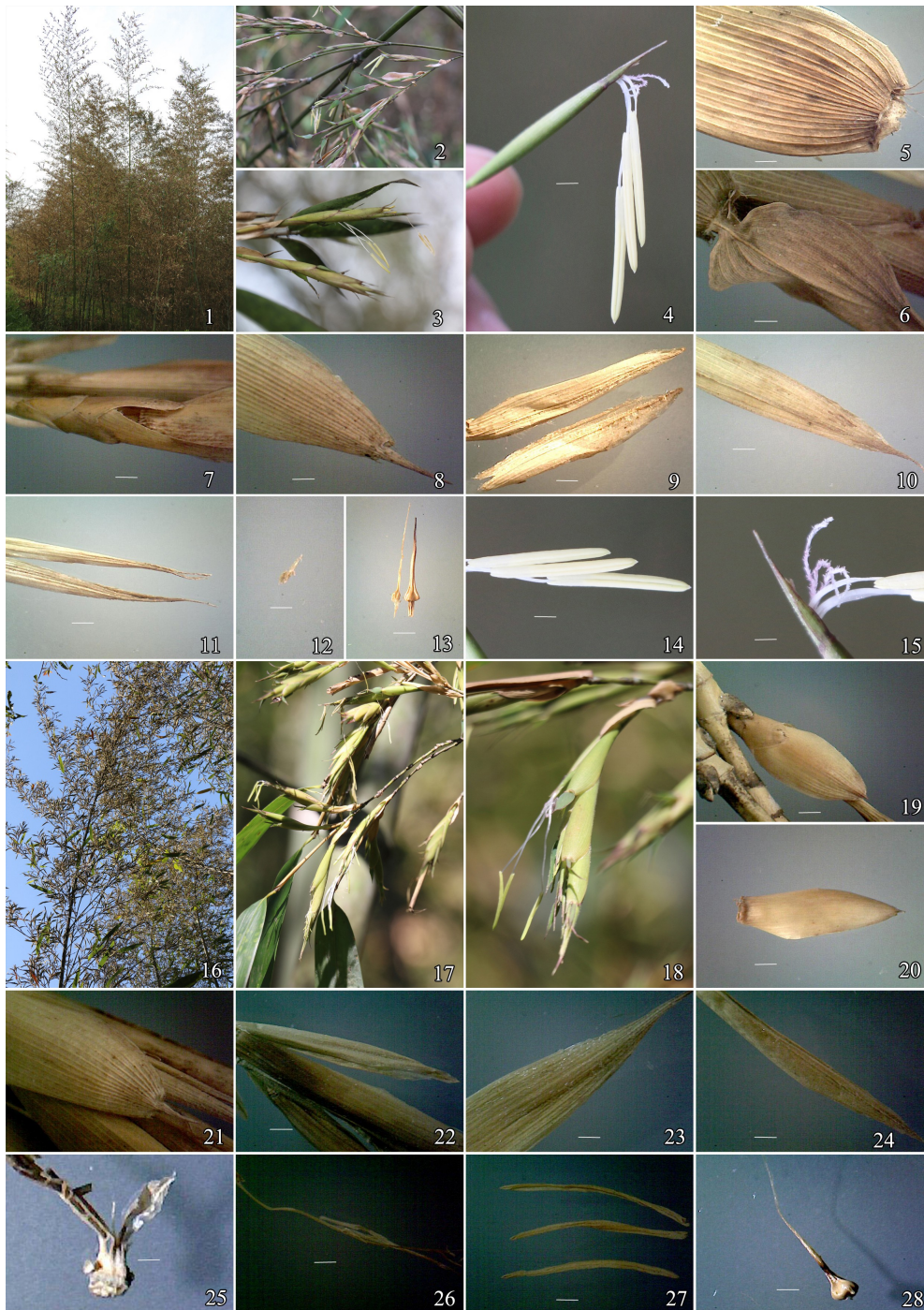


Plate II 1–15 *Phyllostachys purpureociliata* G. H. Lai 1. Flowering plants; 2. Flowering branches, showing spicate iterant inflorescence; 3. Pseudospikelet; 4. A floret; 5. Upper part of spathe in dorsal view; 6. Spathe with reduced leaf in dorsal view; 7. Bracts at the base of pseudospikelet; 8. Upper part of bract in dorsal view; 9. Glumes in dorsal view; 10. Middle and upper part of lemma in ventral view; 11. Upper part of lemma and palea in lateral view; 12. Lodicule; 13. Ovary with a long stipe and style; 14. Anthers; 15. Stigmas. 16–28 *Phyllostachys yunhoensis* S. Y. Chen et C. Y. Yao 16. Flowering plants; 17. Flowering branches, showing capitate iterant inflorescence; 18. Pseudospikelet; 19. Bracts at the base of iterant inflorescence; 20. A bract in dorsal view; 21. Upper part of largest bract at the base of iterant inflorescence in dorsal view; 22. Glume in lateral view; 23. Middle and upper part of lemma in dorsal view;

24. Palea in lateral view; 25. Lodicule; 26. A part of filament; 27. Anthers; 28. Ovary and style. Scale bars: 4–11, 14, 15, 20–24, 28=2 mm; 12, 26, 27=1 mm; 13, 19=3 mm; 25=0.5 mm.